University of the West of England
BRISTOL

MODULE SPECIFICATION

Part 1: Information			
Module Title	Applied Radiation & Rehabilitation Engineering		
Module Code	USSKLG-30-3	Level	3
For implementation from	September 2017		
UWE Credit Rating	30	ECTS Credit Rating	15
Faculty	Health & Applied Sciences	Field	Applied Sciences
Department	Applied Sciences		
Contributes towards	BSc (Hons) Healthcare Science (Clinical Engineering)		
Module type:	Standard		
Pre-requisites	USSKLB-30-2 Advanced Clinical Engineering USSKLC-30-2 Applied Clinical Engineering		
Excluded Combinations	N/A		
Co- requisites	N/A		
Module Entry requirements	Level 5 (or equivalent) biomedical engineering qualification		

Part 2: Description

This module explores the clinical environment and contains two distinct units, namely

- Unit 1: Applied Radiation Engineering
- Unit 2: Applied Rehabilitation Engineering

Students complete one of these units as prescribed by their pathway. Unit 1 aligns to the Healthcare Science (Clinical Engineering) Radiation Engineering pathway. Unit 2 aligns to the Healthcare Science (Clinical Engineering) Rehabilitation Engineering pathway.

The syllabus covers:

1. Applied Radiation Engineering [Radiation Engineering pathway]

- Practical safety that applies when working in a radiotherapy department.
  - Radiation - Safety standards and hazards that apply when working with ionising and non-ionising radiation- national and local rules
  - Electrical
  - Mechanical
  - Radiotherapy and related equipment
- Structure of Equipment – major component parts
- Operation of Linear Accelerator Technology
  - Beam generation

        - Flatness, Focussing, Symmetry, Energy, Dose rate and dose accuracy, Alignment
    - Waveguide
    - Radio Frequency (RF) system
    - Cooling systems
    - High Tension (HT) systems
    - Vacuum systems
    - Interlocks systems and how they affect the operation of the equipment.
    - Control systems applied to the operation of radiation equipment.
- Operation and use of
    - Laser centring systems
    - Multi-leaf Collimation (MLC)
    - Wedges
    - Image generation equipment
- Computer systems used in Diagnostic and Treatment
    - Principles of operation
    - Importance in the modern Radiotherapy departments
    - Patient Verification systems
- Operation of Superficial Treatment
- Operation of Imaging Equipment
    - Diagnostic x-ray equipment
    - Simulators
    - Computed Tomography (CT)
    - Magnetic Resonance Imaging (MRI)
    - Positron Emission Tomography (PET)
- Machine procedures
    - Start, run-up and shut-down procedures
    - Maintenance and fault finding protocols and procedures
    - Calibration
    - Safety testing
- Quality Systems
    - Procedures and work instructions. ISO9000:2000
    - Importance of accurate recording of results, reports, certificates of serviceability and other documentation
    - Quality control of measuring equipment
- Introduction of other medical equipment into a Ionising or Non-ionising radiation environment
    - Risks
    - Artefacts
    - Interference
    - Possible impact on Patient Outcomes
- Review the application of new and impending technology and techniques

2. Applied Rehabilitation Engineering [Rehabilitation Engineering pathway]

- Equipment management applied to Rehabilitation Engineering and Assistive Technology
- Quality systems and controls
- Product Knowledge
    - Researching methods
    - Principles of device operation
    - Manuals, protocols and training information
    - Accessories
    - Availability
    - Costing
    - Construction of device, including transportation requirements
    - Controls
    - Control of infection
    - Operation implications
        - Safety, suitability, running costs, additional resource implications
- Clinical Practice
    - Rehabilitation Engineering in The Health Service
    - The Rehabilitation Engineer in the professional healthcare team
    - Psychosocial aspects and classification of disabilities (including the International Classification of Functioning)

    - Assessment Methods
    - Other Professional Roles (Occupational Therapist, Physiotherapist, Speech Therapist, Consultant in Rehabilitation Medicine)
    - Communication With Client and Carer
    - Postural Management
    - Development and Prevention of Deformity
- Assessment
    - Disabling Pathologies and prognosis
    - Psychological state
    - Communication abilities/limitations
    - Physical abilities/limitations
    - Musculo-skeletal abilities/limitations
    - Neuro muscular abilities/limitations
    - Social goals/limitations
    - Mobility goals/limitations
    - Postural management/needs
    - Carer needs/abilities
- Measurements
    - Types and range of measurements
    - Measurement limitations
    - Anatomical measurements
    - Specialist Measuring Equipment
    - Use of photography
- Prescribing
    - Limitations
    - Multi-disciplinary Team
        - Roles, Scope of practice
    - Funding
    - Services ability to deliver solution
- Trialling devices
- Modification
    - Risk assessments
    - Specification
    - Designing
    - Manufacture
    - Legislation, regulations and guidance
    - Testing
    - Documentation
    - CE marking
    - Outsourcing
    - Inspection
    - Acceptance
- Repairs
    - Protocols
    - Knowledge of equipment
    - Outsourcing
    - Monitoring
    - Inspection
    - Acceptance
    - Documentation
- Testing
    - Mechanical tests
    - Electrical tests
    - Functional Tests
- Risk assessments
    - Environment, local, wider
    - Users/Carers
    - Device specific

There will be 3 weeks of contact time at UWE in 3 x 1 week blocks. Included in each block week are laboratory workshops, lectures and tutorials. The contact time will equate to approximately 12 hours per block (a total of 36 hours).

In addition to the allocated hours on campus learning, students will engage in synchronous and asynchronous online learning. This will comprise a total of approximately 36 hours of online engagement through a combination of lectures, synchronous online tutorials, synchronous and asynchronous discussions, online quizzes, and collaborative group work.

Theoretical material within the module will be presented to the students in the form of regular lectures throughout each of the semesters in the academic year. During those times of work based learning, these lectures will be delivered online and involve a number of technological enhancements. The learning of lecture content will be reinforced through time spent in independent learning by the directed reading of recommended texts and through the use of technology enhanced learning resources that will be provided online. This online learning and engagement will be delivered through several avenues:

- Synchronous online tutorials in protected learning time where the student will contribute/attend an online activity appropriate to the content at the time at which the academic will be present online to facilitate and lead this scheduled/timetabled session. This tutorial will be themed/planned.
- Asynchronous discussions in the student's own time (or during protected time where permitted and appropriate) where they will engage/collaborate with other students on the course or in specified groups, and in which the academic is permitted to moderate where necessary, but is not expected to contribute.
- Synchronous surgery sessions timetabled for a specific time in which the academic will be available online to answer live questions via discussion boards/blogs/collaborate or to respond to questions posted/asked prior to the session.
- Interactive, online formative quizzes made available either following a particular package of knowledge exchange/learning, or in specified sessions/time periods.
- Lectures delivered online through a combination of one or more of the following: visual/audio/interactivity/personal formative assessment

A number of relevant practical sessions will be incorporated during the campus based blocks in addition to the work based learning that must be achieved under supervision by a workplace supervisor. Practical sessions will both drive hands on learning and the acquisition of technical skills at both an individual and group working level.

The remainder of the independent learning time allocated to the module should be spent preparing for assessments [B1], and undertaking revision for the exams [A1, A2].

Scheduled learning includes lectures, seminars, tutorials, project supervision, demonstration, practical classes and workshops; fieldwork; external visits; work based learning; supervised time in studio/workshop.

Independent learning includes hours engaged with essential reading, case study preparation, assignment preparation and completion etc. These sessions constitute an average time per level as indicated in the table below. Scheduled sessions may vary slightly depending on the module choices you make.

Part 3: Assessment

The Assessment Strategy has been designed to support and enhance the development of both subject-based and more general skills, whilst ensuring that the modules learning outcomes are attained, as described below.

Component A

The written exam will provide students with an opportunity to demonstrate both their knowledge on a broad range of topics through a series of short essay questions.

The in-class open book test will assess the students' ability to research relevant information and provide critical thinking in a variety workplace scenarios where the application of knowledge is required.

Component B

The 20 minute presentation (with supporting evidence) will be an opportunity for the student to evaluate how theoretical knowledge supports the relevant engineering field in the clinical environment.

Formative feedback is available to students throughout the module through group discussions, and in workshops. Students are provided with formative feed-forward for their exam through a revision and exam preparation session prior to the exam and through the extensive support materials supplied through Blackboard.

All work is marked in line with the Faculty's Generic Assessment Criteria and conforms to university policies for the setting, collection, marking and return of student work. Where an individual piece of work has specific assessment criteria, this is supplied to the students when the work is set.

This assessment strategy has been designed following best practice on effective assessment from JISC (http://www.jisc.ac.uk/whatwedo/programmes/elearning/assessment/digiassess.aspx) and The Open University's Centre for Excellence in Teaching and Learning (http://www.open.ac.uk/opencetl/centre-open-learning-mathematics-science-computing-and-technology/activities-projects/e-assessment-learning-the-interactive-comp).

Technical design and deployment of the activities will also follow best practice developed at UWE by the Education Innovation Centre in collaboration with academic colleagues across the university. Staff guidance and support are already in place (http://info.uwe.ac.uk/online/Blackboard/staff/guides/summative-assessments.asp).

Identify final timetabled piece of assessment (component and element)	A2	
% weighting between components A and B (Standard modules only)	**A:** **50**	**B**: **50**

First Sit	
Component A (controlled conditions) **Description of each element**	**Element weighting** **(as % of component)**
1. Examination (1.5 hours)	50%
2. Open book in-class test (1.5 hours)	50%
Component B **Description of each element**	**Element weighting** **(as % of component)**
1. 20 minute presentation with supporting evidence	100%
Resit (further attendance at taught classes is not required)	
Component A (controlled conditions) **Description of each element**	**Element weighting** **(as % of component)**
1. Examination (3 hours)	100%
Component B **Description of each element**	**Element weighting** **(as % of component)**
1. 20 minute presentation with supporting evidence	100%

Part 4: Teaching and Learning Methods	
Learning Outcomes	On successful completion of this module students will be able to fulfil the learning outcomes from 1 of the following 2 Clinical Engineering themed units of study: • Unit 1: Applied Radiation Engineering • Unit 2: Applied Rehabilitation Engineering Unit 1 aligns to the Healthcare Science (Clinical Engineering) Radiation Engineering pathway. Unit 2 aligns to the Healthcare Science (Clinical Engineering) Rehabilitation Engineering pathway. **1. Applied Radiation Engineering [Radiation Engineering pathway]** • Critically evaluate the construction and structure of radiotherapy and ionising radiation imaging equipment by identifying key component areas and the explaining the part they play in the operation of the equipment [A1] • Understand the practical operation of a variety of systems used to modify or target the delivery of treatment [A1, B1] • Demonstrate an understanding of the installation of imaging and treatment equipment and knowledge of machine procedures [A1, B1] • Understand the use of computer networks in the delivery of radiation imaging and treatment services [A1] • Understand the importance of quality systems and the need for accuracy in documentation and records [A2] • Critically evaluate the problems that may be encountered when bringing other medical devices into the clinical environment [A2, B1] • Understand the empathy and sensitivity needed when dealing with the patient experience of long-term conditions and terminal illness [A2, B1] **2. Applied Rehabilitation Engineering [Rehabilitation Engineering pathway]** • Critically evaluate a range of assistive technology solutions, including mobility, posture control, environmental controls and communication aids and appraise the benefits and risks of alternative assistive technology solutions [A1, B1] • Appraise the risks to patients resulting from the modification or incorrect usage of standard assistive devices and propose a plan for reducing patient risk [A1 • Assess clinical needs/patient goals and generate options for suitable assistive technology and interventions, which are within the scope and limitations of the individual patient's capabilities [A1] • Critically evaluate how assistive technology solutions might into the overall treatment care plan as part of a multidisciplinary approach [A1, B1] • Know how to support and instruct users and carers in use, transport, cleaning and general maintenance of assistive devices [A2 • Design bespoke assistive technology solutions [A2 • Critically evaluate new technologies and materials and appraise the appropriateness or use in rehabilitation engineering and assistive technology [A2, B1] • Understand the empathy and sensitivity needed when dealing with the patient experience of long-term conditions and terminal illness [A2, B1]

Key Information Sets Information (KIS)

Key Information Set - Module data

Number of credits for this module	30

Hours to be allocated	Scheduled learning and teaching study hours	Independent study hours	Placement study hours	Allocated Hours
300	72	228	0	300

Contact Hours

The table below indicates as a percentage the total assessment of the module which constitutes a;

Written Exam: Unseen or open book written exam
Coursework: Written assignment or essay, report, dissertation, portfolio, project or in class test
Practical Exam: Oral Assessment and/or presentation, practical skills assessment, practical exam (i.e. an exam determining mastery of a technique)

Total Assessment

Total assessment of the module:	
Written exam assessment percentage	50%
Coursework assessment percentage	0%
Practical exam assessment percentage	50%
	100%

Reading List

Modernising Scientific Careers Programme Training Manual for appropriate Division and Specialist Route. Available from http://www.nshcs.hee.nhs.uk/curricula

Applied Radiation Engineering

Hoskin, P.J. and Goh, V. (2010) Radiotherapy in practice: imaging. Oxford: Oxford University Press.

Symonds, P., Deehan, C., Meredith, M., and Mills, J. (2012) Walter and Miller's Textbook of Radiotherapy London: Churchill Livingstone.

Applied Rehabilitation Engineering

Adrian, M. and Cooper, J.M. (1995) Biomechanics of Human Movement. 2nd ed. New York: Brown & Benchmark.

Rothwell, J. (2013) Control of Human Voluntary Movement. 2nd ed. Berlin: Springer.

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